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Original Article

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Comparison of Temporomandibular Joint Disorders Between Patients Treated with Hemodialysis versus Peritoneal Dialysis

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ABSTRACT

Objective: The primary aim of this study was to investigate the difference, if any, in the frequency of temporomandibular joint disorders between patients with end-stage kidney disease (ESKD) and healthy individuals. Our secondary aim was to compare the frequency of temporomandibular joint disorders between patients with end-stage kidney disease treated with hemodialysis versus peritoneal dialysis.
Methods: All participants completed a questionnaire and underwent a dental evaluation to confirm temporomandibular joint disorder.
Results: The frequencies of temporomandibular joint disorders were 13% and 8.9% in the patient and control groups (P = .35), respectively, and 13.4% and 12% in the hemodialysis and peritoneal dialysis groups, respectively (P = 0.85).
Conclusions: We observed no difference in temporomandibular joint disorder frequency between patients with end-stage kidney disease who received hemodialysis and peritoneal dialysis as kidney replacement therapy and between patients with ESKD and healthy individuals. Further large-scale studies are warranted to gain a deeper understanding of this topic.
Keywords: Dialysis, end-stage kidney disease, peritoneal dialysis, sleep bruxism, temporomandibular joint diseases

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INTRODUCTION

Temporomandibular joint disorders (TMD) are the most common conditions associated with chronic orofacial pain and affect approximately 10%-15% of the adult population.[1-4] The prevalence of TMD is higher in women than in men.[1-4] The onset of TMD is most common between the ages of 18 and 44 years.[3] Temporomandibular joint disorders are associated with significant morbidity and negatively affects patients' quality of life.

Temporomandibular joint disorders are associated with a multifactorial etiology, including parafunctional habits, poor health conditions, acute trauma to the jaw, rheumatic or musculoskeletal disorders, and psychiatric comorbidities.[3] Psychiatric comorbidities involved in the pathophysiology of TMD include depression, stress, and anxiety.[1,5] Temporomandibular joint disorders manifest as decreased mandibular range of motion, muscle and joint pain, joint crepitus, functional limitation or jaw deviation during mouth opening, and bruxism.[3,6] Bruxism is defined as repetitive jaw muscle activity characterized by clenching or grinding of teeth and/or bracing or thrusting of the mandible.[7,8] Bruxism is most common during sleep and affects 8–10% of adults.[9]

Temporomandibular joint disorders are diagnosed based on the patient's history and physical examination findings.[6] A history of facial pain, pain with jaw function, limitation of jaw movements, and cracking sounds associated with jaw function represent typical symptoms

of TMD.[6] Specific physical examination findings include facial or jaw tenderness, limited mouth opening, bruxism, and temporomandibular joint (TMJ) sounds.[6] Temporomandibular joint disorder treatment is aimed at pain reduction and improved jaw function. Most individuals with TMD respond to treatment; however, a few patients develop chronic disease.[6]

Although many studies have investigated sleep disturbances, psychological states, and oral health in patients who undergo hemodialysis (HD) and peritoneal dialysis (PD),[10-14] a limited number of studies have compared the frequency of TMD between patients who receive HD versus PD treatment. Moreover, only a few studies reported in the literature have investigated TMD in patients with end-stage kidney disease (ESKD).[11, 14] To our knowledge, this is the first study to compare TMD between patients who received HD versus PD. Based on responses to specific questionnaires and clinical and laboratory data, we investigated and compared the prevalence of TMD in patients with ESKD and healthy individuals. Our secondary aim was to compare the prevalence of TMD among patients who received HD versus PD treatment. In our view, accurate diagnosis and timely intervention are important to improve the quality of life of patients with ESKD.

METHODS

Study Group Selection

This case-control study investigated TMD in patients who received HD and PD treatment and compared these patients with healthy volunteers. The study was approved by the Baskent University Institutional Review Board and Ethics Committee (Project no: D-KA 19/08) and supported by the Baskent University Research Fund. Informed consent was obtained from all participants. All procedures that involved human participants were performed in accordance with the ethical standards of the Institutional Research Committee and in accordance with the 1975 Helsinki Declaration and its later amendments or comparable ethical standards.

All patients treated with HD or PD (n = 98) who met the inclusion criteria and provided informed consent were invited to participate in the study. All participants had the mental capacity to respond to the questionnaire. Six patients refused to participate for unknown reasons, and their data were not recorded. Over the 6-month study period, 101 control patients who met the inclusion criteria were invited to participate in the survey. The groups were homogenized, and the participants were matched with regard to demographic variables using the PSMatch procedure. Patient and control groups were matched because age and sex are known risk factors for TMD. Nine participants older than those in the patient group were excluded from the control group; therefore, finally, our study included 92 patients each in the control and patient groups. These groups were statistically matched for age, sex distribution, and body mass index.

Inclusion Criteria

The study included both men and women aged 18-65 years. This study was performed between March 2019 and September 2019.

Initially, participants were categorized into the following groups: patients who received high-flux HD treatment (blood flow = 350 mL/min, 4-hour sessions thrice a week) for at least 3 months at the X Hemodialysis Center (HD group), patients who received continuous ambulatory PD treatment for at least 3 months at the X PD clinic (PD group), and patients who were selected from among the hospital employees and patients' relatives (control group).

Eventually, the HD and PD groups were referred to as the "patient group" and the group comprising healthy volunteers as the "control group."

Exclusion Criteria

Following were the exclusion criteria in this study: limited cognitive ability (e.g., mental retardation, schizophrenia, uncontrolled affective disorders, and dementia), diagnosis of neurological or musculoskeletal disorders (e.g., Parkinson's disease, stroke, and epilepsy), rheumatic joint diseases, clinically unstable conditions (e.g., infections or malignancies), analgesic drug intake within 48 hours before the study, psychiatric medication use, and trauma to the jaw.

Study Data

The current study included 67 patients who underwent HD (38 men/29 women, mean age 52.4 ± 15.2 years), 25 patients who underwent PD (14 men/11 women, mean age 50.3 ± 14.5 years), and 92 healthy volunteers (48 men/44 women, mean age 47.9 ± 11.6 years). These groups were statistically matched for age, sex distribution, and body mass index. A medical history survey was administered as an eligibility test by the same nephrologist to all participants.

Procedures

Patients' clinical and demographic characteristics and routine laboratory test results were recorded at the beginning of the study. We recorded age, sex, weight, and height. Weight and height were measured using a scale and stadiometer, respectively, and the body mass index (body weight [kg]/height^2 [m^2])

MAIN POINTS

- Temporomandibular joint disorders (TMD) are the most common conditions associated with chronic orofacial pain, and associated with negatively affect patients' quality of life.
- Only a few studies reported in the literature have investigated TMD in patients with end-stage kidney disease (ESKD).
- In this study, we observed no significant difference in TMD frequency between HD and PD and between patients with ESKD and healthy individuals.
- However, further large-scale studies are warranted to improve awareness among physicians regarding the fact that TMD can impair quality of life in patients with ESKD.

was calculated. Relevant sociodemographic data (marital status, education level, smoking habits, and alcohol consumption levels) were recorded. The clinical characteristics (comorbidities, causes of ESKD, and duration of dialysis therapy) of patients who underwent HD and PD were recorded. A history of psychiatric medications, if any, was recorded in all patients.

The following laboratory parameters were recorded in the patient group: serum hemoglobin, calcium, phosphorus, albumin, parathyroid hormone, low-density lipoprotein (LDL), triglycerides, and the Kt/V urea (an index of dialysis adequacy). With regard to the Kt/V urea index, single pool Kt/V values < 1.2 were considered abnormal in patients who underwent HD, and weekly Kt/V values < 1.7 were considered abnormal in those who underwent PD.[13] Serum hemoglobin levels were measured using a Cell Dyn 3700 hematology analyzer (Abbott Laboratories, Abbott Park, Ill, USA). Other biochemical parameters were measured using a Roche Hitachi 902 chemistry analyzer (Roche Diagnostics Corporation, Indianapolis, Ind, USA) based on standard laboratory methods.

Evaluation of Temporomandibular Joint Disorders

This study was performed at the HD/PD centers and dental clinics at the X University X Health Campus. All patients underwent evaluation by the same maxillofacial surgeon using the same method for diagnosis of TMD. We performed clinical examination and distributed a questionnaire that patients completed during dialysis sessions or while they waited for their appointment, and the process was completed in approximately 10-15 min. The differential diagnosis of TMD was made by the same maxillofacial surgeon based on specific criteria.[15, 16] The questionnaire used to determine TMD symptoms included information regarding oral behavior and parafunctional habits. The survey was followed by a clinical examination performed by the same maxillofacial surgeon on all participants. The surgeon's examination results were recorded in a form that was adapted from Schiffman's study[15] (Table 1). The diagnosis of TMD is based primarily upon the clinical history and physical examination findings. To confirm the diagnosis, attention was paid to the presence of two of the three most common cardinal symptoms of TMD in patients. These jaw pain (when moving jaw), limited mouth opening (limitations in jaw opening), and TMJ noise (clicking or popping).[17, 18] Additionally other examinations and questions in the survey were selected and edited from the original survey to identify the other symptoms and parafunctional habits (like bruxism, etc) that cause TMD to support the diagnosis of TMD.

Clinical examination included extraoral and intraoral muscle palpation, TMJ palpation, auscultation of the TMJ for joint sounds, estimation of the range of mandibular motion, and inspection of the dentition for abnormalities. Palpation of the masticatory muscles was performed using the palmar surface of the middle and index fingers. Soft but firm pressure was applied to the muscles, and participants were instructed to report any pain. Pain was considered an indicator of muscle sensitivity. Maximum mouth opening was measured clinically using a ruler. Patients were instructed to open their mouths as wide as they could, and the distance between the incisal edge of the upper and lower anterior teeth was measured and recorded as the maximum mouth opening distance. The normal functional mouth opening distance varies between 35 and 55 mm.[4] The lower limit of the mouth opening distance was determined to be < 35 mm.

Statistical Analysis

The Statistical Package of Social Science (SPSS, Chicago, Ill, USA, version 25) software was used in the statistical analysis of the data. Patients' history/symptoms and clinical examination data were entered into the SPSS program. Normally distributed continuous variables were expressed as means ± standard deviation ($P > .05$) using the Kolmogorov–Smirnov or the Shapiro–Wilk test (n < 30), and non-normally distributed continuous variables were expressed as the median value. Intergroup comparisons were performed using the Student's *t*-test (patient and control groups) for normally distributed data and the Mann–Whitney *U*-test for non-normally distributed data. Intergroup

Table 1. Questionnaire Form (Adapted From Schiffman's Study[15])

Survey questions (This section is to be filled by the participants)		
Which of the following symptoms have you had during the past year?		
Do you have any oral or facial pain?	Yes	No
Do you feel any pain when you move your jaw?	Yes	No
Are there any limitations in your jaw movements?	Yes	No
Do you hear any clicking or popping during your jaw movements?	Yes	No
Do you feel the need to bite on something or hold objects between your teeth? (e.g., pens, pipe, hair, fingernails)	Yes	No
Do you clench or grind your teeth when asleep?	Yes	No
Do you habitually chew gum?	Yes	No
Do you habitually chew ice?	Yes	No
Do you habitually chew on one side?	Yes	No
Does your jaw lock involuntary?	Yes	No
Intraoral Examination (This section is to be filled by the maxillofacial surgeon)		
Jaw deviation	Yes	No
Presence of linea alba (cheek)	Yes	No
Tooth wear/attrition	Yes	No
Muscle sensitivity	Yes	No
Preauricular pain	Yes	No
Limited mouth opening	Yes	No
Bruxism	Yes	No
Noises of temporomandibular joint	Yes	No

Table 2. Comparison of Baseline Characteristics of Participants Between Patients and Control Group

	Patients Group (n = 92)	Control Group (n = 92)	*P*
Age (years), mean ± SD	51.8 ± 15.0	47.9 ± 11.6	.05
Male, n (%)	52 (56.5)	48 (52.2)	.65
Body mass index (kg/m²), mean ± SD	24.8 ± 4.6	25.6 ± 3.3	.20
Education#			
Primary or secondary school, n (%)	84 (91.3)	62 (67.4)	**.00***
High school or higher, n (%)	4 (4.3)	30 (32.6)	
Marital status			
Married, n (%)	67 (72.8)	80 (87)	**.02***
Single, n (%)	25 (27.2)	12 (13)	
Smoking habits, n (%)	28 (30.4)	41 (44.6)	.06
Depression or anxiety, n (%)	61 (66.3)	45 (48.9)	**.02***
Sleep disorders, n (%)	46 (50)	15 (16.3)	**.00***

#Four patients with ESKD could not read or write. **P* < .05 statistically significant.

comparison of categorical variables was performed using the chi-square test or Fisher's exact test. A *P* value <0.05 was considered statistically significant.

RESULTS

The control group also included 92 participants (48 men/44 women, mean age 47.9 ± 11.6 years), who were matched with the patients in the ESKD group with regard to age and sex. Among the patients with ESKD, 67 and 25 received HD and PD, respectively. No participant reported a history of excessive alcohol consumption or psychiatric medication use. No participant showed any visible sign of TMJ pathology.

Comparison of Patient and Control Groups

Education level (*P* < .001) and prevalence of married individuals (*P* = .02) were higher in the control group. The prevalence of depression/anxiety (*P* = .02) and sleep disorders (*P* < .001) was higher in the patient group. Table 2 shows a comparison of the baseline characteristics between the patient and control groups.

The frequency of TMD was 13% (n = 12) and 8.9% (n = 9) in the patient and control groups, respectively (*P* = .35). The prevalence of chewing gum (*P* < .001), chewing ice (*P* < .001), and unilateral food chewing (*P* = .01) was higher in the patient group. Limitation of jaw movement (*P* < .001), linea alba (cheek) (*P* < .001), and bruxism (*P* < .001) was more frequent in the control group. Table 3 shows a comparison of TMD features between the patient and control groups. TMD was observed in 11.5% of men and 15% of women in patients with ESKD. No statistically significant difference was observed with regard to TMD based on sex in patients with ESKD (*P* = .62).

Table 3. Comparison of Temporomandibular Joint Disorders Between Patients and Control Group

	Patients Group (n = 92)	Control Group (n = 92)	*P*
Survey questions			
Oral-facial pain, n (%)	15 (16.3)	18 (19.6)	.70
Limitation of jaw movement, n (%)	12 (13)	28 (30.4)	**.00***
Joint noises when the jaw movement, n (%)	13 (14.1)	19 (20.7)	.33
Bite or hold objects between teeth, n (%)	6 (6.5)	1 (1.1)	.11
Clenching or grinding teeth when asleep, n (%)	28 (30.4)	48 (52.2)	**.00***
Habit of chewing gum, n (%)	38 (41.3)	15 (16.3)	**.00***
Habit of chewing ice, n (%)	24 (26.1)	2 (2.2)	**.00***
Unilateral chewing, n (%)	50 (54.3)	33 (35.9)	**.01***
Involuntary jaw joint locking, n (%)	10 (10.9)	11 (12)	1.00
Intraoral examination			
Jaw deviation, n (%)	32 (34.8)	24 (26.1)	.26
Presence of linea alba (cheek), n (%)	28 (30.4)	50 (54.3)	**.00***
Tooth wear/attrition, n (%)	68 (73.9)	60 (65.2)	.26
Muscle sensitivity, n (%)	16 (17.4)	24 (26.1)	.21
Preauricular pain, n (%)	20 (21.7)	12 (13)	.17
Limited mouth opening, n (%)	16 (17.4)	12 (13)	.53
Bruxism, n (%)	24 (26.7)	31 (50.8)	**.00***
Noises of TMJ, n (%)	18 (19.6)	19 (20.7)	.00
Presence of TMDs, n (%)	12 (13)	9 (8.9)	.35

TMJ, temporomandibular joint, TMDs, temporomandibular joint disorders. **P* < .05 statistically significant.

Comparison of Patients who Received Hemodialysis and Peritoneal Dialysis

We observed no significant difference between the HD and PD groups with regard to patients' baseline characteristics. Serum LDL (*P* < .001) levels were higher and serum albumin (*P* < .001) levels were lower in the PD group (Table 4). The mean Kt/V value of the patients in both groups (1.56 ± 0.28 for the HD group, 2.18 ± 0.49 for the PD group) was above the target value.

The frequency of TMD was 13.4% (n = 9) and 12% (n = 3) in the HD and PD groups, respectively (*P* = .85). We observed no

Table 4. Baseline Characteristics of Patients with End-Stage Kidney Disease

Variable	Dialysis Modality		*P*
	HD (n = 67)	PD (n = 25)	
Age (years), mean ± SD	52.4 ± 15.2	50.3 ± 14.5	.55
Male, n (%)	38 (56.7)	14 (56)	1.00
Body mass index (kg/m^2), mean ± SD	24.3 ± 4.6	26.2 ± 4.7	.09
Education			
Primary or secondary school, n (%)	63 (94)	21 (84)	.14
High school or higher, n (%)	2 (3)	2 (8)	
Marital status			
Married, n (%)	49 (73.1)	18 (72)	1.00
Single, n (%)	18 (26.9)	7 (28)	
Smoking habits, n (%)	22 (32.8)	6 (24)	.45
Depression or anxiety, n (%)	46 (68.7)	15 (60)	.46
Sleep disorders, n (%)	34 (50.7)	12 (48)	1.00
Co-morbidity, n (%)	57 (85)	20 (80)	.54
Time on dialysis (years), median (range)	5.5 (0.5–22)	4.6 (0.5–16)	.29
Causes of ESKD			
Diabetes, n (%)	21 (31.3)	5 (20)	0.36
Unknown, n (%)	17 (25.4)	4 (16)	
Hypertension, n (%)	14 (20.9)	9 (36)	
Glomerulonephritis, n (%)	6 (9)	4 (16)	
Nephrolithiasis, n (%)	2 (3)	2 (8)	
Polycystic kidney disease, n (%)	4 (6)	0 (0)	
Others, n (%)	3 (4.5)	1 (4)	
Laboratory findings			
Hemoglobin (g/L), mean ± SD	11.4 ± 1.7	10.9 ± 1.6	0.21
Calcium (mg/dL), mean ± SD	8.80 ± 0.94	8.80 ± 0.84	0.99
Phosphorus (mg/dL), mean ± SD	4.9 ± 1.3	4.4 ± 1.3	0.12
Albumin (g/L), mean ± SD	3.84 ± 0.35	3.50 ± 0.38	**0.00***
PTH (pg/mL), median (range)	333 (0-2228)	383 (54-1347)	0.99
C-reactive protein (mg/dL), median (range)	5 (2-233)	9.5 (2-78)	0.50
LDL-cholesterol (mg/dL), median (range)	81 (35-189)	116 (53-180)	**0.00***
Triglycerides (mg/dL), median (range)	143 (33-775)	113 (47-404)	0.20

HD, hemodialysis; PD, peritoneal dialysis; LDL, low-density lipoprotein; PTH, parathyroid hormone. *$P < .05$ statistically significant.

Table 5. Comparison of Temporomandibular Joint Disorders Between Patients Treated with Hemodialysis versus Peritoneal Dialysis

Survey Questions	Dialysis Modality		*P*
	HD (n = 67)	PD (n = 25)	
Oral-facial pain, n (%)	10 (14.9)	5 (20)	.54
Limitation of jaw movement, n (%)	9 (13.4)	3 (12)	1.00
Joint noises when the jaw movement, n (%)	10 (14.9)	3 (12)	1.00
Bite or hold objects between teeth, n (%)	5 (7.5)	1 (4)	.68
Clenching or grinding teeth when asleep, n (%)	19 (28.4)	9 (36)	.61
Habit of chewing gum, n (%)	32 (47.8)	6 (24)	.05
Habit of chewing ice, n (%)	18 (26.9)	6 (24)	.78
Unilateral chewing, n (%)	38 (56.7)	12 (48)	.48
Involuntary jaw joint locking, n (%)	9 (13.4)	1 (4)	.27
Intraoral examination			
Jaw deviation, n (%)	26 (38.8)	6 (24)	.22
Presence of linea alba (cheek), n (%)	24 (35.8)	4 (16)	.07
Tooth wear/attrition, n (%)	51 (76.1)	17 (68)	.43
Muscle sensitivity, n (%)	9 (13.4)	7 (28)	.12
Preauricular pain, n (%)	13 (19.4)	7 (28)	.40
Limited mouth opening, n (%)	10 (14.9)	6 (24)	.35
Bruxism, n (%)	21 (31.3)	3 (13)	.10
Noises of temporomandibular joint, n (%)	15 (22.4)	3 (12)	.37
Presence of TMDs, n (%)	9 (13.4)	3 (12)	.85

HD, hemodialysis; PD, peritoneal dialysis; TMDs, temporomandibular joint disorders.
*$P < .05$ statistically significant.

statistically significant differences with regard to TMD symptoms and signs between the HD and PD groups (Table 5).

DISCUSSION

Dental care is usually a neglected component of medical management of patients with ESKD and is rarely investigated in dentistry. Numerous studies have investigated psychological well-being,[10] sleep disorders,[11,12] and oral health (including dental caries, periodontitis, and oral lesions) in patients with ESKD.[13,14] However, the current study specifically focused on symptoms and signs of TMD among patients with ESKD.

Reportedly, the prevalence of TMD is 10%-15% in the general population.[1,3] However, the prevalence in patients with ESKD

remains unclear. Hemodialysis-induced changes in the TMJ were first reported by Dick and Jones[19]; TMD was observed in 6 of 39 (15.3%) patients with HD. In 1985, Locsey et al[20] reported painful TMJ in 10 of 44 (22.7%) patients with HD. The frequency of TMD in patients with HD (13.4%) in our study was similar to that reported in the literature. A Brazilian study reported that the rates of TMD signs and symptoms in patients with ESKD were lower than those reported by previous studies (2.5% and 3.8%, respectively).[13]

In this study, we initially investigated the effects of the aforementioned dialysis modalities (HD vs. PD) on the prevalence of TMD. To our knowledge, this is the first study to investigate TMD in patients with PD. The frequency of TMD in patients with PD was 12% in our study. Losso[11] compared patients who received HD versus PD but only with regard to sleep disorders and reported no intergroup difference with regard to bruxism. Similarly, we observed no difference between the HD and PD groups with regard to bruxism (31.3% vs. 13%, $P = .10$) in the present study. In the current study, we observed no statistically significant differences with regard to TMD between patients who underwent HD and PD.

The second component of our research included a comparison between patients with ESKD and healthy individuals. Increased thirst is a frequent and stressful symptom experienced by patients who undergo HD.[21] A pilot study investigated ice-chewing habits secondary to increased thirst in patients with ESKD.[21] Previous studies have described the benefits of chewing sugar-free gum for xerostomia in patients with ESKD.[22-24] In the current study, chewing gum or ice, and habitual chewing on a particular side were more frequent among patients with ESKD.

A previous study reported that tooth erosion is not a significant risk factor for TMD.[25] In our study, we observed no significant difference in tooth wear/attrition between patients who underwent HD versus PD and between the patient vs. control groups.

Dialysis-related amyloidosis is a major complication observed in patients who undergo long-term HD.[26] A previous case report has described dialysis-related amyloidosis of the TMJ.[26] In view of risk factors such as dialysis-induced amyloidosis, kidney osteodystrophy, high stress levels, and depression, TMD is expected to be more common in patients with ESKD than in healthy individuals. Contrary to expectations, in this study, only a few symptoms of TMD such as chewing gum or ice and habitual chewing on a specific side were more common among patients with ESKD than in the control group, which leads to the presumption that habitual TMD symptoms observed in patients with ESKD can perhaps be considered adverse effects of dialysis. Interestingly, TMD symptoms such as the limitation of jaw movements, linea alba, and bruxism were more frequent in the control group; this unexpected result could be attributed to the fact that the participants in the control group were selected from among hospital staff members and patients' relatives, and stress levels among hospital staff and patients' relatives were as high as the stress levels observed in patients.

A few studies have investigated the frequency of TMD in patients who receive dialysis therapy.[14,27] An oral health survey reported a higher prevalence of TMD symptoms (jaw pain) in patients with ESKD than in healthy controls (16.7% vs. 5.7%).[14] In contrast, in the current study, we observed no significant intergroup difference with regard to orofacial pain (a symptom of TMD). Our study differed from the aforementioned survey because only one symptom suggestive of TMD (jaw pain) was included in the questionnaire. Another recent study reported that patients who underwent HD were more susceptible to TMD than healthy individuals.[27]

Reportedly, TMD usually affect women more than men.[1-4] In the present study, we observed no sex difference with regard to TMD in patients with ESKD.

The mean Kt/V levels (an indicator of the adequacy of dialysis) were at ideal thresholds in both the HD and PD groups. Serum albumin levels were significantly lower, and lipid levels were significantly higher in patients with PD. These intergroup differences are not unusual in patients who undergo HD and PD. Similarly, low education levels, a higher likelihood of being unmarried, high prevalence of depression/anxiety, and sleep disorders were expected in patients with ESKD.

Following are the limitations of this study: Responses to the questionnaire obtained from patients may not be reliable owing to a lack of knowledge or education, which could be considered a drawback of this study. The control group participants were selected among hospital employees and patients' relatives, which could serve as a limitation. An additional questionnaire could have been administered to assess depression. Low sample size especially in the PD group and the single-center nature of the study can be considered as another limitation. It may be beneficial to include kidney osteodystrophy findings of ESKD patients in similar studies to be conducted in the future.

The strongest aspect of this study: To our knowledge, this is the first study that compared TMD between HD and PD (modalities used for kidney replacement therapy) in patients with ESKD. Physicians (specifically those associated with dialysis management) should be aware of the possibility of TMD that can affect the quality of life in patients with ESKD, and these patients should therefore undergo thorough dental evaluation at regular intervals.

CONCLUSIONS

In this study, we observed no significant difference in TMD frequency between HD and PD and between patients with ESKD and healthy individuals. However, further large-scale studies are warranted to improve awareness among physicians regarding the fact that TMD can impair the quality of life in patients with ESKD.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Başkent University (Date: March 15, 2019, Decision No: D-KA19/08).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Peer-review: Externally peer-reviewed.

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